State of California
The Resources Agency
Department of Water Resources

RECREATION SUITABILITY ANALYSIS

FINAL

R-15

Oroville Facilities Relicensing
FERC Project No. 2100

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FERC Project No. 2100

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REPORT SUMMARY

This document presents the results of the Recreation Suitability Analysis, one of several recreation studies that were conducted for the Oroville Facilities relicensing. This study provides an analysis of recreation site development suitability using geographic information system (GIS)-based technology to identify and assess areas of opportunity and constraint for potential recreation development in the study area. Composite GIS suitability maps were developed to visually display areas with the potential for new public recreation facility development if it is determined that they are needed.

Federal Energy Regulatory Commission (FERC) regulations require a comprehensive recreation plan. This study is being conducted in support of this plan. The study identifies areas potentially suitable for new recreation site development that may be used to help meet the recreation needs of visitors to the study area.

The objective of this study is to determine areas suitable for potential new recreation facility development, if needed, consistent with the resource opportunities and constraints of the area. For potential recreation facility development, two objectives were considered when preparing this study. One objective was to provide a range of recreation experiences for visitors, both developed and dispersed; the other objective was to protect the Project's sensitive resources. Both of these objectives were considered when selecting opportunity and constraint values to be compared and contrasted.

Opportunity values that were considered included physical, biological, and legal property characteristics that are favorable for potential future recreation development. Examples of opportunity values include proximity to the shoreline and proximity to existing roads so that infrastructure needs be minimized. Constraint values that were considered included characteristics that are not favorable for recreation development, such as extreme slopes and proximity to areas with sensitive species. Through this process, opportunity and constraint characteristics were classified into low, moderate, and high subcategories.

A composite map was developed that incorporates both opportunity and constraint characteristics. By combining these characteristics, areas of high, moderate, and low general suitability were depicted. The resulting composite suitability map depicts potentially suitable sites (or polygons) that may be considered for future recreation development if needed. Areas of high suitability may include areas of infill and expansion of existing recreation sites, as well as new undeveloped sites. For example, highly suitable potential recreation development areas are those where high opportunities and low or no constraints exist, whereas less suitable recreation areas are those where greater constraints or no opportunities exist. The composite suitability maps do not contain the mapped results of the cultural resource inventory (Relicensing Study C-1 – Cultural Resources Inventory); however, a map depicting the density of archaeological sites is included in Appendix A. Therefore, certain areas that appear

highly suitable on the composite suitability maps may potentially have cultural resource concerns. Before planning and developing new recreation sites, including infill and expansion of existing sites, a thorough archaeological survey may need to occur.

The following lands comprise the most potentially-suitable locations that were identified in this study for consideration of a new recreation development, if needed, in the study area. These sites will require further on-site verification and extensive environmental review prior to any definitive project planning.

- Lands near Lime Saddle Boat Ramp (BR) and Lime Saddle Campground;
- Lands near the Bloomer Area Boat-in Campsites (BIC);
- Lands near Spillway Day Use Area (DUA) and BR and Oroville Dam Overlook DUAs;
- Lands adjacent to the Loafer Creek and Bidwell Canyon facilities;
- A thin strip of land near the Bald Rock Canyon access;
- A large inland area to the east of Craig Area BIC;
- Lands near the west end of the Diversion Pool, close to the Lakeland Boulevard trail access;
- Lands adjacent to the North and South Thermalito Forebay recreation facilities;
- Lands on the north side of the Thermalito Afterbay;
- Lands near the Oroville Wildlife Area (OWA) Headquarters entrance;
- Lands surrounding the Rabe Road Shooting Range and Clay Pit State Vehicular Recreation Area (SVRA);
- Lands along the west side of the Feather River in the OWA; and
- Land in the vicinity of Riverbend Park.

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BR	boat ramp
BIC	boat-in campsites
cfs	cubic feet per second
CTBR	car-top boat ramp
DFG	California Department of Fish and Game
DUA	day use area
DWR	California Department of Water Resources
FERC	Federal Energy Regulatory Commission
FRSA	Feather River Service Area
GIS	geographic information system
ISO	Independent System Operator
maf	million acre-feet
msl	mean sea level
MW	megawatt
NOAA Fisheries	National Oceanic and Atmospheric Administration Fisheries
OWA	Oroville Wildlife Area
PMEs	protection, mitigation, and enhancement measures
PWC	personal watercraft
RM	river mile
SVRA	State Vehicular Recreation Area
SWP	State Water Project
USACE	U.S. Army Corp of Engineers
USDA	U.S. Department of Agriculture

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1.0 INTRODUCTION

This document presents the results of the Recreation Suitability Analysis, one of several recreation studies conducted for Oroville Facilities relicensing. This study provides an analysis of potential recreation site development suitability using geographic information system (GIS)-based technology to identify and assess opportunities and constraints for potential recreation development in the study area. Composite GIS suitability maps were developed to illustrate areas with the potential for new public recreation facility development, if needed.

Opportunity values that were considered included physical, biological, and legal property characteristics that are favorable for potential future recreation development. Examples of opportunity values that were considered included proximity to the shoreline, favorable tree canopy, and proximity to existing roads (so that infrastructure needs would be minimized). Constraint values that were considered included characteristics that are not favorable for recreation development, such as proximity to areas with sensitive species or extreme slopes. Through this process, opportunity and constraint characteristics were classified into low, moderate, and high subcategories.

Composite maps were developed that incorporate both the opportunity and constraint characteristics. By combining these characteristics, areas of high, moderate, and low suitability were depicted. The resulting composite suitability maps depict potential suitable sites (or polygons) for future potential recreation development, if needed.

1.1 BACKGROUND INFORMATION

The California Department of Water Resources (DWR), guided by the Oroville Facilities Relicensing Collaborative, commissioned this study as part of the relicensing process for the preparation of a license application to be submitted to the Federal Energy Regulatory Commission (FERC) for the Oroville Facilities (FERC Project No. 2100). As part of this relicensing process, a series of related studies are being conducted to assess and evaluate recreation resources associated with the Oroville Facilities.

Lake Oroville is the second largest reservoir in California, after Shasta Lake. Numerous existing facilities at Lake Oroville offer a variety of recreational opportunities, including boating, fishing, and camping. Opportunities to camp in the area range from fully developed campgrounds to primitive, less-developed sites. Boat-in and floating campsites also exist. There are two full-service marinas, six boat launches, eight car-top boat launches, ten floating campsites, seven floating toilets, and a visitor center located in the vicinity of Lake Oroville. At Lake Oroville itself, there are major developed recreation facilities at Loafer Creek, Bidwell Canyon, Spillway, and Lime Saddle. Other recreation opportunities include picnicking, swimming, horseback riding, hiking, off-road bicycle riding, personal watercraft (PWC) use, wildlife watching, and hunting. The area also offers visitor information sites with cultural and informational displays about Project

facilities and the area's natural and cultural environment. Additional recreational and visitor facilities are located at Thermalito Diversion Pool, Thermalito Forebay, Thermalito Afterbay, and the Oroville Wildlife Area (OWA).

1.2 DESCRIPTION OF FACILITIES

The Oroville Facilities were developed as part of the State Water Project (SWP) – a water storage and delivery system of reservoirs, aqueducts, power plants, and pumping plants. The main purpose of the SWP is to store and distribute water to supplement the needs of urban and agricultural water users in Northern California, the San Francisco Bay area, the San Joaquin Valley, and Southern California. The Oroville Facilities are also operated for flood control power generation, to improve water quality in the Sacramento-San Joaquin Delta, enhance fish and wildlife, and provide recreation.

FERC Project No. 2100 (Figure 1.2-1) encompasses 41,100 acres and includes Oroville Dam and Reservoir, three power plants (Hyatt Pumping-Generating Plant, Thermalito Diversion Dam Power Plant, and Thermalito Pumping-Generating Plant), Thermalito Diversion Dam, the Feather River Fish Hatchery and Fish Barrier Dam, Thermalito Power Canal, the OWA, Thermalito Forebay and Forebay Dam, Thermalito Afterbay and Afterbay Dam, transmission lines, and a relatively large number of recreational facilities. Oroville Dam, along with two small saddle dams, impounds Lake Oroville, a 3.5-million-acre-foot (maf) capacity storage reservoir with a surface area of 15,810 acres at its maximum normal operating level of 900 feet above mean sea level (msl).

The hydroelectric facilities have a combined licensed generating capacity of approximately 762 megawatts (MW). The Hyatt Pumping-Generating Plant is the largest of the three power plants with a capacity of 645 MW. Water from the six-unit underground power plant (three conventional generating and three pumping-generating units) is discharged through two tunnels into the Feather River just downstream of Oroville Dam. The plant has a generating and pumping flow capacity of 16,950 cubic feet per second (cfs) and 5,610 cfs, respectively. Other generation facilities include the 3-MW Thermalito Diversion Dam Power Plant and the 114-MW Thermalito Pumping-Generating Plant.

Thermalito Diversion Dam, 4 miles downstream of the Oroville Dam, creates a tailwater pool for the Hyatt Pumping-Generating Plant and is used to divert water into the Thermalito Power Canal. Thermalito Diversion Dam Power Plant is located on the left abutment of the Diversion Dam. The power plant releases a maximum of 615 cfs into the river.

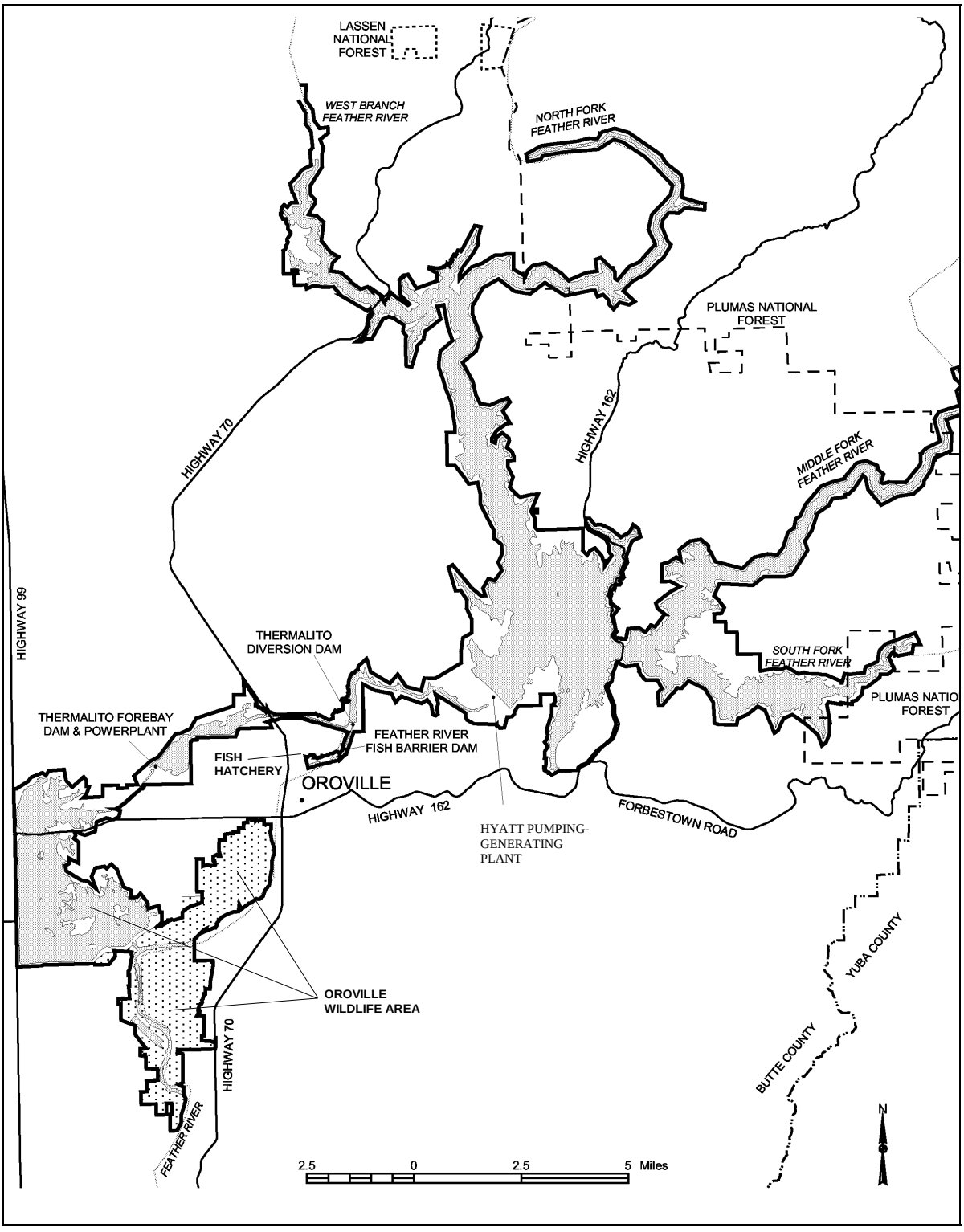

Figure 1.2-1. Oroville Facilities FERC Project Boundary.

The Power Canal is a 10,000-foot-long channel designed to convey generating flows of 16,900 cfs to the Thermalito Forebay and pump-back flows to the Hyatt Pumping-Generating Plant. Thermalito Forebay is an off-stream regulating reservoir for the 114-MW Thermalito Pumping-Generating Plant. The Thermalito Pumping-Generating Plant is designed to operate in tandem with the Hyatt Pumping-Generating Plant and has generating and pump-back flow capacities of 17,400 cfs and 9,120 cfs, respectively. When in generating mode, the Thermalito Pumping-Generating Plant discharges into Thermalito Afterbay, which is contained by a 42,000-foot-long earth-fill dam. The Afterbay, which is used to release water into the Feather River downstream of the Oroville Facilities, helps regulate the power system, provides storage for pump-back operations, provides recreational opportunities, and provides local irrigation water. Several local irrigation districts also receive Lake Oroville water via the Afterbay.

The Feather River Fish Barrier Dam is downstream of the Thermalito Diversion Dam and immediately upstream of the Feather River Fish Hatchery. The flow over the dam maintains fish habitat in the low-flow channel of the Feather River between the dam and the Afterbay outlet, and provides attraction flow for the hatchery. The hatchery is an anadramous fish hatchery intended to compensate for salmon and steelhead spawning grounds made unreachable by construction of Oroville Dam. Hatchery facilities have a production capacity of 10 million fall-run salmon, 5 million spring-run salmon, and 450,000 steelhead annually (pers. comm., Kastner 2003). Diseases have occasionally reduced hatchery production in recent years, however.

The Oroville Facilities support a wide variety of recreational opportunities. They include several types of boating and fishing, fully developed and primitive camping (including boat-in and floating sites), picnicking, swimming, horseback riding, hiking, off-road bicycle riding, wildlife watching, hunting, and visitor information sites with cultural and informational displays about the developed facilities and the natural environment. There are major recreation facilities at Loafer Creek, Bidwell Canyon, Spillway, Lime Saddle, and Thermalito Forebay. Lake Oroville has two full-service marinas, five car-top boat launch ramps, ten floating campsites, and seven two-stalled floating toilets. There are also recreation facilities at the Lake Oroville Visitors Center, Thermalito Afterbay, and the OWA.

The OWA comprises approximately 11,000 acres west of Oroville that is managed for wildlife habitat and recreational activities. It includes the Thermalito Afterbay and surrounding lands (approximately 6,000 acres), along with 5,000 acres adjoining the Feather River. The 5,000-acre area is adjacent to or straddles 12 miles of the Feather River, and includes willow and cottonwood-lined ponds, islands, and channels. Recreation areas include dispersed recreation (hunting, fishing, and bird watching), plus recreation at developed sites, including Monument Hill Day Use Area (DUA), model airplane grounds, two primitive camping areas, and three boat launches on the Afterbay and two on the river. California Department of Fish and Game's (DFG) habitat enhancement program includes a wood duck nest-box program and dry land farming for

nesting cover and improved wildlife forage. Limited gravel extraction also occurs in a few locations.

1.3 CURRENT OPERATIONAL CONSTRAINTS

Operation of the Oroville Facilities varies seasonally, weekly, and hourly, depending on hydrology and the objectives that DWR is trying to meet. Typically, releases to the Feather River are managed to conserve water while meeting a variety of water delivery requirements, including flow, temperature, fisheries, diversion, and water quality. Lake Oroville stores winter and spring runoff for release to the Feather River as necessary for Project purposes. Meeting the water supply objectives of the SWP has always been the primary consideration for determining Oroville Facilities operation (within the regulatory constraints specified for flood control, instream fisheries, and downstream uses). Power production is scheduled within the boundaries specified by the water operations criteria noted above. Annual operations planning is conducted for multi-year carryover storage. The current methodology is to retain half of the Lake Oroville storage above a specific level for subsequent years. Currently, that level has been established at 1,000,000 acre-feet (af); however, this does not limit drawdown of the reservoir below that level. If hydrology is drier or requirements greater than expected, additional water could be released from Lake Oroville. The operations plan is updated regularly to reflect forecast changes in hydrology and downstream operations. Typically, Lake Oroville is filled near its maximum operating level of 900 feet above msl in June and then lowered as necessary to meet downstream requirements, to a minimum level in December or January (occasionally below 700 feet msl). During drier years, the reservoir may be drawn down more and may not fill to desired levels the following spring. Project operations are directly constrained by downstream operational demands and flood management criteria, as described below.

1.3.1 Downstream Operation

An August 1983 agreement between DWR and DFG, entitled “Agreement Concerning the Operation of the Oroville Division of the State Water Project for Management of Fish & Wildlife,” sets criteria and objectives for flow and temperatures in the low-flow channel and the reach of the Feather River between Thermalito Afterbay and Verona. This agreement: (1) establishes minimum flows between Thermalito Afterbay Outlet and Verona, which vary by water year type; (2) requires flow changes under 2,500 cfs to be reduced by no more than 200 cfs during any 24-hour period (except for flood management, failures, etc.); (3) requires flow stability during the peak of the fall-run Chinook salmon spawning season; and (4) sets an objective of suitable temperature conditions during the fall months for salmon and during the later spring/summer for shad and striped bass.

1.3.1.1 Instream Flow Requirements

The Oroville Facilities are operated to meet minimum flows in the lower Feather River as established by the aforementioned 1983 agreement. The agreement specifies that the Oroville Facilities release a minimum of 600 cfs into the Feather River from the Thermalito Diversion Dam for fisheries purposes. This is the total volume of normal flow from the Diversion Dam outlet, Diversion Dam powerplant, and the Feather River Fish Hatchery pipeline.

Generally, the instream flow requirements below Thermalito Afterbay are 1,700 cfs from October through March, and 1,000 cfs from April through September. However, if runoff for the previous April through July period is less than 1,942,000 af (i.e., the 1911-1960 mean unimpaired runoff near Oroville), the minimum flow can be reduced to 1,200 cfs from October to February, and 1,000 cfs for March. A maximum flow of 2,500 cfs is not exceeded from October 15 through November 30 to prevent spawning in overbank areas that might become dewatered.

1.3.1.2 Temperature Requirements

The Diversion Pool provides the water supply for the Feather River Fish Hatchery. The hatchery temperature objectives are 52°F for September, 51°F for October and November, 55°F for December through March, 51°F for April through May 15, 55°F for last half of May, 56°F for June 1-15, 60°F for June 16 through August 15, and 58°F for August 16-31. In April through November, a temperature range of plus or minus 4°F is allowed for objectives.

There are several temperature objectives for the Feather River downstream of the Afterbay outlet. During the fall months, after September 15, the temperatures must be suitable for fall-run Chinook salmon. From May through August, the temperatures must be suitable for shad, striped bass, and other fish.

The National Oceanic and Atmospheric Administration Fisheries (NOAA Fisheries) has also established an explicit criterion for steelhead trout and spring-run Chinook salmon, included in a biological opinion on the effects of the Central Valley Project and SWP on Central Valley spring-run Chinook and steelhead. As a reasonable and prudent measure, DWR attempts to control water temperature at Feather River Mile (RM) 61.6 (Robinson's Riffle in the low-flow channel) from June 1 through September 30. This measure attempts to maintain water temperatures less than or equal to 65°F on a daily average. The requirement is not intended to preclude pump-back operations at the Oroville Facilities needed to assist the State of California with supplying energy during periods when the California Independent System Operator (ISO) anticipates a Stage 2 or higher alert.

The hatchery and river water temperature objectives sometimes conflict with temperatures desired by agricultural diverters. Under existing agreements, DWR provides water for the Feather River Service Area (FRSA) contractors. The contractors claim a need for warmer water during spring and summer for rice germination and growth (i.e., minimum 65∀F from approximately April through mid-May, and minimum 59∀F during the remainder of the growing season), though there is no explicit obligation for DWR to meet the rice water temperature goals. However, to the extent practical, DWR does use its operational flexibility to accommodate the FRSA contractors' temperature goals.

1.3.1.3 Water Diversions

Monthly irrigation diversions of up to 190,000 af (e.g., in July 2002) are made from the Thermalito Complex during the May through August irrigation season. Total annual entitlement of the Butte and Sutter County agricultural users is approximately 1 maf. After meeting these local demands, flows into the lower Feather River (and outside of the FERC Project boundary) continue into the Sacramento River and into the Sacramento-San Joaquin Delta. In the northwestern portion of the Delta, water is pumped into the North Bay Aqueduct. In the south Delta, water is diverted into Clifton Court Forebay and stored until it is pumped into the California Aqueduct.

1.3.1.4 Water Quality

Flows through the Delta are maintained to meet Bay-Delta water quality standards arising from DWR's water rights permits. These standards are designed to meet several water quality objectives such as salinity, Delta outflow, river flows, and export limits. The purpose of these objectives is to attain the highest reasonable water quality, considering all demands being made on the Bay-Delta waters. In particular, they protect a wide range of fish and wildlife including Chinook salmon, Delta smelt, striped bass, and the habitat of estuarine-dependent species.

1.3.2 Flood Management

The Oroville Facilities are an integral component of the flood management system for the Sacramento Valley. During the winter, the Oroville Facilities are operated under flood control requirements specified by the U.S. Army Corps of Engineers (USACE). Under these requirements, Lake Oroville is operated to maintain up to 750,000 af of storage space to allow for the capture of significant inflows. Flood control releases are based on the release schedule in the flood control diagram or the emergency spillway release diagram prepared by the USACE, whichever requires the greater release. Decisions regarding such releases are made in consultation with the USACE.
The flood control requirements are an example of multiple use of reservoir space. When flood management space is not required to accomplish flood management objectives, the reservoir space can be used for storing water. From October through

March, the maximum allowable storage limit (point at which specific flood release would have to be made) varies from about 2.8 to 3.2 maf to ensure adequate space in Lake Oroville to handle flood flows. The actual encroachment demarcation is based on a wetness index, computed from accumulated basin precipitation. This allows higher levels in the reservoir when the prevailing hydrology is dry. When the wetness index is high in the basin (i.e., high potential runoff from the watershed above Lake Oroville), required flood management space is at its greatest to provide the necessary flood protection. From April through June, the maximum allowable storage limit is increased as the flooding potential decreases, which allows capture of the higher spring flows for use later in the year. During September, the maximum allowable storage decreases again to prepare for the next flood season. During flood events, actual storage may encroach into the flood reservation zone to prevent or minimize downstream flooding along the Feather River.

2.0 NEED FOR STUDY

FERC regulations require a comprehensive recreation plan. This study is being conducted in support of this plan. The study identifies areas that are potentially suitable for new recreation site development that may be used to help meet Project-related recreation needs of visitors to the study area. This study also helps address Issue Statement R1, "adequacy of existing Project recreation facilities, opportunities, and access to accommodate current use and future demand."

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3.0 STUDY OBJECTIVES

The overall objective of this study is to determine areas suitable for potential new recreation facility development, if needed, consistent with the resource opportunities and constraints of the area. For potential recreation facility development, two objectives were considered when preparing this study. One objective was to provide a range of recreation experiences for visitors, both developed and dispersed; the other objective was to protect the Project's sensitive resources. This study includes the shorelines of Project waterways and lands within the FERC Project Boundary (Figure 1.2-1), and includes recreation areas within about a ¼ mile outside or otherwise adjacent to the FERC Project Boundary, such as the Clay Pit State Vehicular Recreation Area (SVRA).

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4.0 METHODOLOGY

This study provides an analysis of the suitability of areas for potential recreation facility development in the study area (Figure 1.2-1). This methodology seeks to balance potential recreation facility development needs and a diversity of desired visitors' experiences with resource protection and land use/management needs. This study addresses both the Lake Oroville area (especially along the reservoir shoreline), as well as the area below Oroville Dam (including Thermalito Forebay and Afterbay, Diversion Pool, the OWA, and the Feather River).

The opportunity to locate new potential recreation site development in the study area is assessed using geographic information system (GIS) based technology. This analysis considered several opportunities and constraints to such development at each of the Project impoundments, waterways, and surrounding lands. GIS is a macro-scale approach and is not meant to replace "on-the-ground" observations that may be used to help develop specific protection, mitigation, and enhancement measures (PMEs) in the future. Rather, GIS may be used to help answer broader questions related to potential recreation facility siting. For example, if a new campground or an expanded existing campground is needed in the future to satisfy demand, this study identifies possible sites for consideration.

The study area is defined as shoreline areas and lands in and within ¼ mile of the FERC boundary. Developed recreation sites within about a ¼ mile outside or otherwise adjacent to the FERC Project Boundary were also included in this analysis. The study area was also adjusted to account for logical development barriers such as freeways, water bodies, rail lines, and residential areas.

4.1 GIS DATA LAYER REVIEW AND IDENTIFICATION

Opportunities for and constraints to potential recreation site development were assessed using a series of available GIS data layers. GIS data layers were obtained from DWR, and some were produced by the authors (EDAW). Specific opportunity and constraint GIS data layers used in this assessment are:

Recreation Suitability Opportunities

- Favorable road access;
- Favorable slope for development;
- Existing recreation sites for potential infill or expansion;
- Public land; and
- Favorable shoreline access within FERC boundary.

Recreation Suitability Constraints

- ∉ Sensitive species and buffers;
- ∉ Sensitive vegetation communities;
- ∉ Moderate to high slope areas;
- ∉ Geologic features (including landslides and rock outcrops);
- ∉ Inundated areas;
- ∉ Private land; and
- ∉ Land outside the FERC boundary that is not within existing Project-related recreation site or area.

4.1.1 Cultural Resources

As a part of the relicensing studies, cultural resources within the study area were inventoried (Relicensing Study C-1 – *Cultural Resources Inventory*). From the results in this study, a site density map was developed depicting the density of known archaeological sites within the FERC boundary. The information depicted on the site density map was not included in the development of the composite suitability maps in Section 5.0; however, the site density map is included in Appendix A of this report.

Cultural resources are highly sensitive. As a result, there are limitations to including the cultural resources layer in this report's suitability maps. Additionally, it is difficult to classify the cultural resources densities into low, moderate, and high constraints and there are portions of the study area that were not surveyed. Culturally sensitive sites may still occur in areas appearing to be "non-sensitive" or low density (just in smaller numbers), and some recreational developments could still occur in "high sensitivity" or high density areas without creating particularly difficult cultural site impact ramifications. These factors made it difficult to determine how to categorize the densities into high, moderate, or low constraints. However, the likelihood of having potential development constrained by cultural resources in higher density areas is increased. To address this consideration, after the composite suitability maps were developed, areas of high suitability were compared with the archaeological site density map. A review of recreation suitability in the context of sensitive archaeological resources is presented in the results. Generally, given equal choices from a recreation development perspective, targeting non-sensitive areas is usually the better course of action.

In the end, mitigation required to proceed with potential recreational development, if any, will need to be supported by an archaeological survey (if the area has not already been surveyed). If potential impacts to archaeological resources are found to be significant (i.e., eligible for the California or National Registers), then development of a plan to avoid or minimize these potential impacts would be necessary.

4.2 ANALYSIS OF RECREATION OPPORTUNITIES

This task identified areas that may be considered for potential future recreation site development or dispersed recreation use if needed. Opportunities are defined as characteristics that allow for sustainable recreation development. By compiling the GIS data layers listed in Section 4.1, "opportunity" polygons were identified and mapped.

Areas considered to be opportunities included those areas within or near existing recreation areas, areas with a slope of no more than 20 percent, DWR-managed or publicly owned lands, and lands within 500-1,000 feet of an existing road (where there would be less need to extend infrastructure).

Each opportunity variable/polygon was ranked as "high," "moderate," or "low" using the criteria shown in Table 4.2-1. Once ranked, the GIS data layers were overlaid, and a map showing all land areas in the study area that meet one or more of the opportunity criteria was produced. Water bodies and Project facilities were classified as "excluded" areas and were not ranked as opportunities.

Table 4.2-1. Recreation site development opportunity classifications and rankings considered.

Opportunity Classification		Opportunity Ranking			
		High	Moderate	Low	Excluded
Water	Reservoirs/rivers				X
Project facilities	Dams, powerhouses, etc.				X
Recreation use	Existing public recreation sites for infill	X			
	Proximity to existing public recreation sites for potential expansion (500 feet)	X			
	Inside FERC boundary	X			
Slope	0–10 percent	X			
	10–20 percent		X		
	Greater than 20 percent			X	
Property ownership	DWR	X			
	U.S. Department of Agriculture (USDA) Forest Service/public	X			
	Private utility		X		
Road access	Proximity to existing highways and roads	<500 ft	500-1000 ft		

Source: EDAW, Inc.

4.3 ANALYSIS OF RECREATION CONSTRAINTS

This task identified areas of recreation constraint that must be considered when contemplating future recreation site development or dispersed use. Using the GIS data layers and polygons listed in Section 4.1, "constraint" polygons were identified and mapped. Constraints are defined as characteristics that may make recreation site development inappropriate for one or more reasons.

Constraint mapping was used to examine and identify potential constraints, including incompatible land uses, riparian corridors, steep slopes, and geologic hazards. Certain ownership factors were also identified as constraints to future suitability.

Areas considered constrained were those areas with a slope of greater than 20 percent, privately owned lands, landslide areas, and lands within or near sensitive habitats or wetland/riparian corridors. Water bodies and Project facilities were classified as excluded areas and were not ranked as constraints.

Each constraint variable/polygon was ranked as high, moderate, or low (Table 4.3-1). Once ranked, GIS data layers were overlaid, and a map showing these three categories was produced. After reviewing and refining the map, the rankings were revised, as needed, and the GIS set was re-run to produce a final constraint overlay map set showing all land areas that meet one or more of these classifications and rankings.

4.4 ANALYSIS OF RECREATION DEVELOPMENT SUITABILITY

The opportunity and constraint maps were overlaid to develop a composite suitability map set depicting areas of high, moderate, and low recreation site development suitability. The resulting composite suitability map shows the most suitable sites (or polygons) for future potential recreation development. For example, highly suitable potential recreation development areas would be those where high opportunities and low or no constraints exist, whereas unsuitable potential recreation areas would be those where high constraints and low or no opportunities exist. For an area to be categorized as having low recreation development suitability, it must have met at least one of the criteria listed as low suitability or as a high constraint. Recreation suitability classifications and corresponding rankings are listed in Table 4.4-1.

Three suitability rankings represent composite conditions comprised of the criteria described above and are depicted on the recreation site development suitability map set in color. Areas on the recreation site development suitability map set identified as having high suitability appear in green, areas with moderate suitability appear in yellow, and areas with low suitability appear in red. Calculations were then performed to determine the acreage of land area in each of the three suitability categories.

Table 4.3-1. Recreation site development constraint classifications and rankings considered.

Constraint Classification		Constraint Ranking			
		High	Moderate	Low	Excluded
Water	Reservoirs/rivers				X
Project facilities	Dams, powerhouses, etc.				X
Slope	10–20 percent		X		
	Greater than 20 percent	X			
Landslide hazard	Active landslide area	X			
	Ancient landslide area		X		
	Inactive landslide area	X			
	Possible landslide area	X			
Property ownership	DWR			X	
	USDA Forest Service / public			X	
	Private utility		X		
	Private undeveloped	X			
	Private developed	X			
Special status species	Proximity to identified species (determined by environmental studies [DWR in prep.])	X			
Wetlands/riparian	Existing	X			
	Identified inundation area	X			
	Proximity to existing wetland/riparian area (determined by environmental studies [DWR in prep.])	X			

Source: EDAW, Inc.

Because of the GIS pixel size and the macro-scale of some of the GIS data layers used, this type of analysis tends to work well for identifying suitable larger polygons (e.g., campgrounds and day use sites), but is less successful in locating linear polygons such as trail corridors or small sites. This analysis does not replace the need for a thorough, on-site analysis, but can help focus decision-makers' attention to relevant areas to potentially meet future recreation needs. Following completion of the suitability mapping, recommendations were made concerning areas that may be considered for potential recreation development.

<u>High suitability areas must have the following characteristics:</u>

- ∉ Favorable road access;
- ∉ Public land;
- ∉ Inside the FERC boundary, *OR* a recreation site (including buffer) outside the FERC boundary; and
- ∉ Favorable slope (0-10 percent).

Table 4.4-1. Recreation site development suitability classifications and rankings considered.

Suitability Classification		Suitability Ranking			
		High	Moderate	Low	Excluded
Water	Reservoirs/rivers				X
Project facilities	Dams, powerhouses, etc.				X
Recreation use	Existing public recreation sites (potential infill)	X			
	Proximity to existing public recreation sites (500 feet) (potential expansion)	X			
Slope	0–10 percent	X			
	10–20 percent		X		
	Greater than 20 percent			X	
Landslide hazard	Active landslide area			X	
	Ancient landslide area		X		
	Inactive landslide area			X	
	Possible landslide area			X	
Property ownership	DWR	X			
	USDA Forest Service / public	X			
	Private utility		X		
	Private undeveloped			X	
	Private developed (includes residential)			X	
Road access	Proximity to existing highways and high quality roads (Level 4 and 5 – per Vehicle Access Study [DWR 2003])	<1000 feet			
	Lower quality roads (Levels 1-3 – per Vehicle Access Study)	<500			
Special status species	Proximity to identified species			X	
Wetlands/riparian	Existing			X	
	Identified inundation area			X	
	Proximity to existing wetland/riparian area			X	

Source: EDAW, Inc.

<u>An area is Low Suitability if one of the following characteristics is present</u>:

- ∉ Slope greater than 20 percent;
- ∉ Private land (non-utility);
- ∉ Active or possible landslide areas; or
- ∉ Sensitive species zone including buffer (determined by environmental studies [DWR in prep.]).

An area CANNOT be a Highly Suitable area (but *MAY* still be moderate) if one or more of the following characteristics are present:

- ∉ Sensitive vegetation community;
- ∉ Private utility land;
- ∉ Inactive / ancient landslides present;
- ∉ Slope of 10-20 percent.

GIS mapping is not the best tool to evaluate potential dispersed use areas as these sites are not often determined by managerial decisions but by user preference for a site. However, suitable areas (classified as high or moderate) along the shoreline may present good opportunities for dispersed recreation activities.

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5.0 STUDY RESULTS

Recreation site development suitability was assessed using GIS technology to overlay and prioritize a number of important opportunity and constraint factors. Three GIS mapping products were developed for each Project resource area – an opportunity map, a constraints map, and a recreation suitability map (composite of the first two). For purposes of this study, the study area was divided into two portions – the Lake Oroville area and the study area below Oroville Dam. Interpretation of the results of the analysis (including a discussion of the data on the GIS maps) is presented in Section 6.0 (Analysis).

5.1 OPPORTUNITY MAPPING

For each of the Project resource areas (Lake Oroville area, and the study area below Oroville Dam), an inventory of recreation opportunity factors was developed. Figures 5.1-1 and 5.1-2 display recreation development opportunities at the north and south ends of Lake Oroville, respectively, while Figure 5.1-3 displays opportunities in the study area below Oroville Dam. These figures were used as building blocks for the composite suitability maps discussed in Section 5.3.

5.2 CONSTRAINT MAPPING

For each of the Project resource areas (Lake Oroville and the study area below Oroville Dam), an inventory of recreation constraint factors was developed. Figures 5.2-1 and 5.2-2 display recreation development constraints at the north and south ends of Lake Oroville, respectively, while Figure 5.2-3 displays constraints in the study area below Oroville Dam. These figures were used as building blocks for the composite suitability maps discussed in Section 5.3.

5.3 COMPOSITE SUITABILITY

This GIS-based analysis is a planning tool intended to identify potential areas for possible recreation site development in the study area, should new facilities be needed to help satisfy existing or future recreation needs. Because of the larger pixel size and larger scale of some of the GIS data layers, this analysis is not intended to be used to site small-scale or linear development, such as trails.

The surface water areas at high pool elevation within the study area were removed from this GIS recreation development suitability analysis. Table 5.3-1 shows the amount of acreage covered under each suitability category. Within the FERC boundary, 3,132 acres (7.6 percent of the total study area) were deemed highly suitable, whereas 419 acres (1.4 percent of the study area) outside the FERC boundary but within the study area were deemed highly suitable.

Table 5.3-1. Acreage of potentially suitable land for recreation site development in the Recreation Suitability Analysis study area.

Suitability Categories		Inside FERC Boundary		Outside FERC Boundary		Study Area	
		Acres	%	Acres	%	Acres	%
Suitability Category	High	3,132	7.6%	419	1.4%	3551	5.0%
	Moderate	3,683	8.9%	1,524	5.2%	5207	7.4%
	Low	14,071	34.2%	26,844	91.8%	40,915	58.1%
Excluded Areas (Includes inundated areas)		20,255	49.2%	463	1.6%	20,718	29.4%
Total		**41,141**	**100%**	**29,251**	**100%**	**70,392**	**100%**

Source: EDAW, Inc.

Suitability for potential recreation site development in the Project area is graphically presented in Figures 5.3-1 through 5.3-6. Categories of suitability for recreational development are presented using a 3-level scale (high, moderate, and low), as previously described (a complete list of opportunity and constraint factors and rankings that were compiled to create the recreation development suitability analysis is presented in Table 4.4-1). Figures 5.3-1 and 5.3-2 show composite suitability for the northern and southern portions of Lake Oroville respectively, while composite suitability for the Project below Oroville Dam is shown in Figure 5.3-3. Close-up views of the Reservoir Main Basin – South, Diversion Pool/Feather River in Oroville, Lime Saddle Area, Foreman Creek Car-top Boat Ramp (BR), and Enterprise BR are provided in Figures 5.3-4 through 5.3-8. Although the results of this assessment indicate that some areas around Foreman Creek Car-top BR (Figure 5.3-7) and Enterprise BR (Figure 5.3-8) are highly suitable, potential impacts to cultural resources are a concern in these areas (Appendix A); therefore, these areas may more likely have low or moderate suitability.

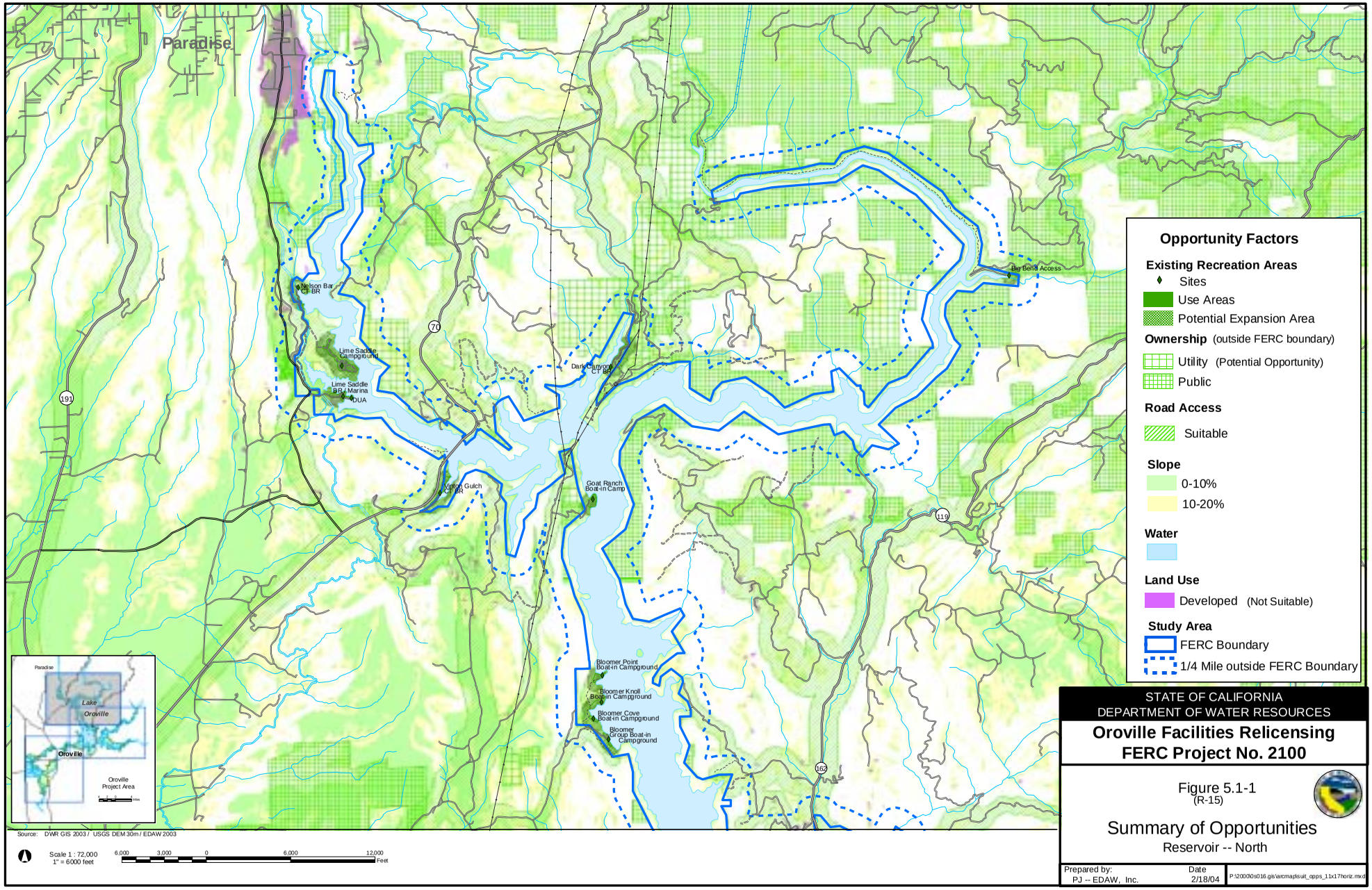
After comparing areas of high suitability with the archaeological site density map (Appendix A), the following areas otherwise determined to be of high suitability may ultimately still have cultural resource limitations:

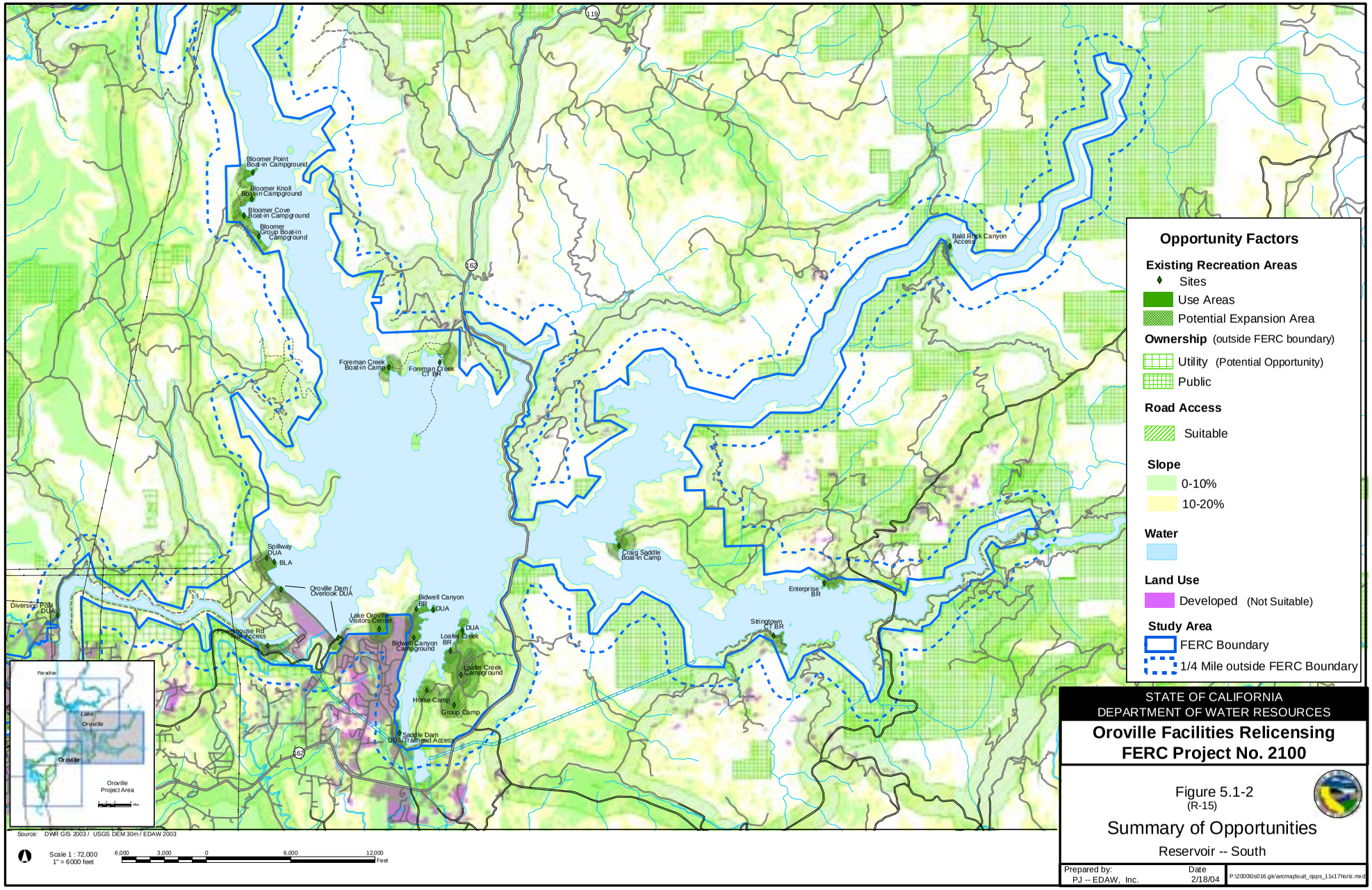
- The vicinity of Lime Saddle and Parrish Cove;
- The Bloomer Cove Area;
- Areas near Craig Saddle; and
- A large expanse near Foreman Creek Car-top BR and Boat-in Campground (BIC).

It is also important to note that areas that appear as low density may still have sensitive cultural resources. Therefore, conducting additional archaeological surveys may be necessary to confirm the appropriateness or adequacy of a specific site for recreation development.

[11x17 inserts]

[8x11 inserts]


Paradise
Nelson Bar Cr BR
Lime Saddle Campground
Lime Saddle BR / Marina
DUA
Dark Canyon Cr BR
Big Bend Access
Goat Ranch Boat-in Camp
Canyon Gulch Cr BR
Bloomer Point Boat-in Campground
Bloomer Knoll Boat-in Campground
Bloomer Cove Boat-in Campground
Bloomer Group Boat-in Campground
70
191
119
162
Opportunity Factors
Existing Recreation Areas
Sites
Use Areas
Potential Expansion Area
Ownership (outside FERC boundary)
Utility (Potential Opportunity)
Public
Road Access
Suitable
Slope
0-10%
10-20%
Water
Land Use
Developed (Not Suitable)
Study Area
FERC Boundary
1/4 Mile outside FERC Boundary
Paradise
Lake Oroville
Oroville
Oroville Project Area
Source: DWR GIS 2003 / USGS DEM 30m / EDAW 2003
Scale 1 : 72,000
1" = 6000 feet
6,000 3,000 0 6,000 12,000
Feet
STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES
Oroville Facilities Relicensing
FERC Project No. 2100
Figure 5.1-1
(R-15)
Summary of Opportunities
Reservoir -- North
Prepared by:
PJ -- EDAW, Inc.
Date
2/18/04
P:\2000\0s016.gis\arcmaps\suit_opps_11x17horiz.mxd



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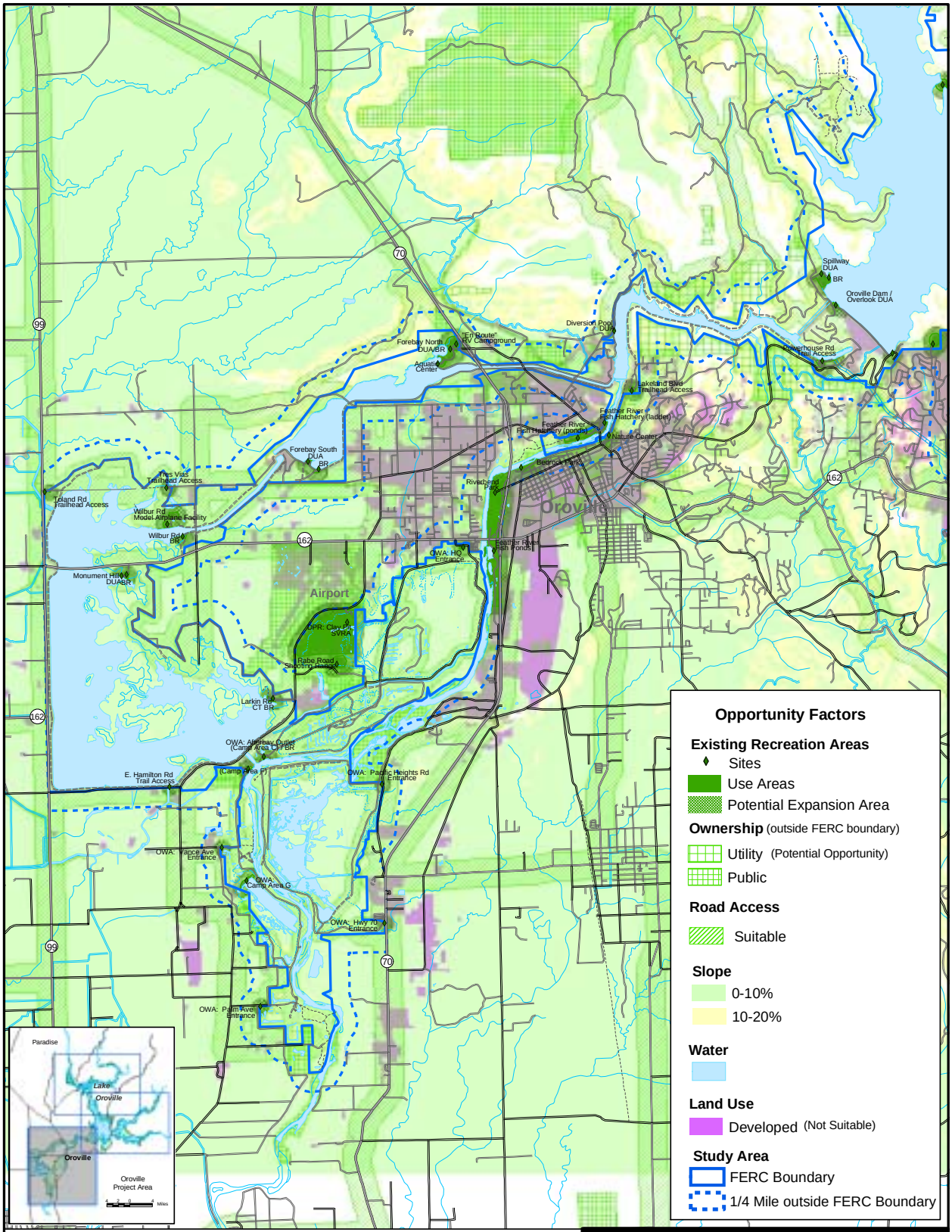
Oroville Facilities Relicensing
FERC Project No. 2100

Figure 5.1-2
(R-15)

Summary of Opportunities

Reservoir -- South

Prepared by:	Date	
PJ -- EDAW, Inc.	2/18/04	P:\2000\os016.gis\arcmaps\suit_opps_11x17horiz.mxd



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DEPARTMENT OF WATER RESOURCES

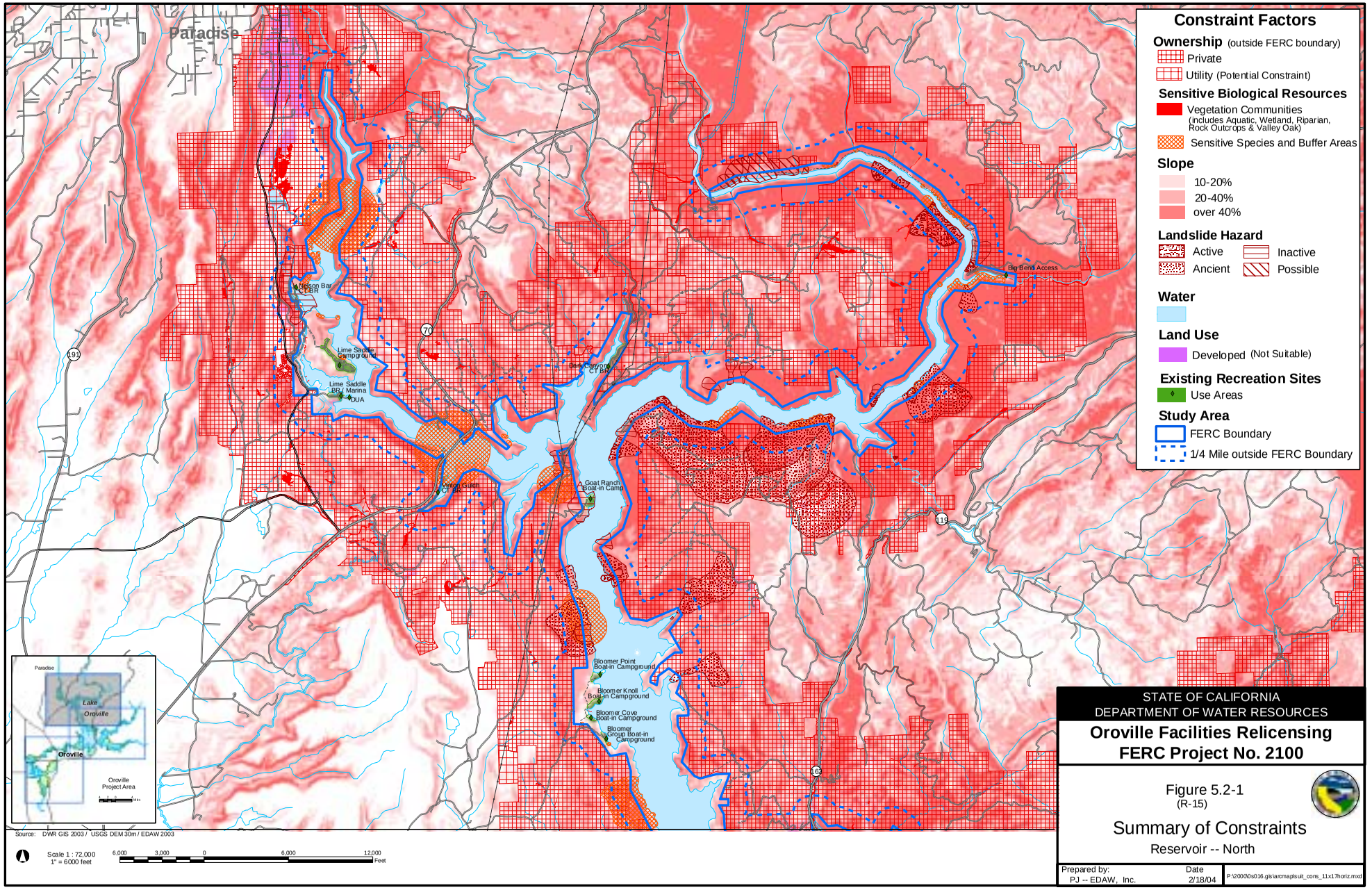
Oroville Facilities Relicensing
FERC Project No. 2100

Figure 5.1-3
(R-15)

Summary of Opportunities

River -- Below Oroville Dam

Prepared by:	Date	
PJ -- EDAW, Inc.	2/18/04	P:\2000\0s016.gis\arcmap\suit_opps_11x17vert.mxd



Constraint Factors

Ownership (outside FERC boundary)
- Private
- Utility (Potential Constraint)

Sensitive Biological Resources
- Vegetation Communities (includes Aquatic, Wetland, Riparian, Rock Outcrops & Valley Oak)
- Sensitive Species and Buffer Areas

Slope
- 10-20%
- 20-40%
- over 40%

Landslide Hazard
- Active
- Inactive
- Ancient
- Possible

Water

Land Use
- Developed (Not Suitable)

Existing Recreation Sites
- Use Areas

Study Area
- FERC Boundary
- 1/4 Mile outside FERC Boundary

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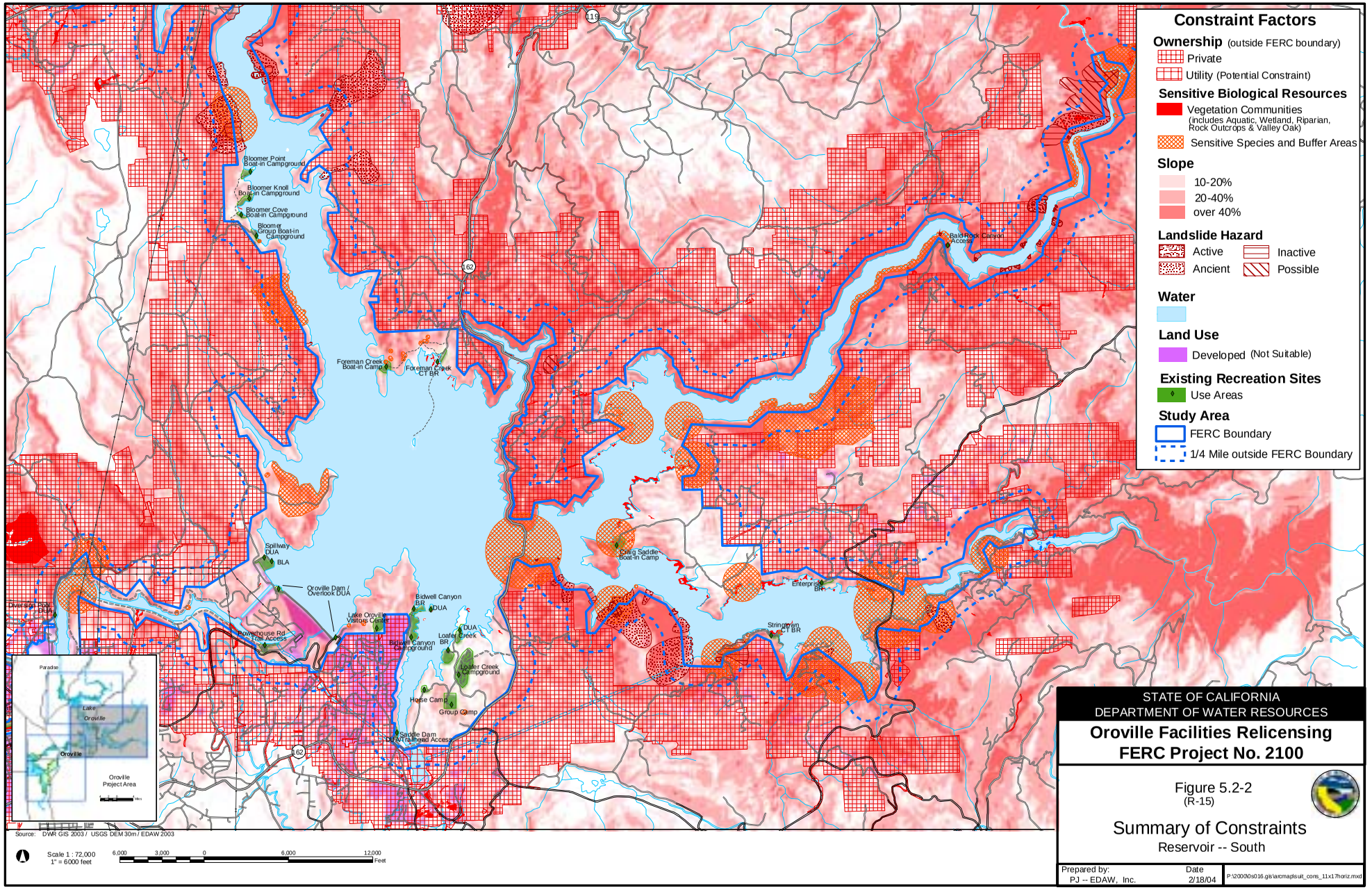
Figure 5.2-1
(R-15)

Summary of Constraints
Reservoir -- North

Prepared by:	Date	
PJ -- EDAW, Inc.	2/18/04	P:\2000\os016.gis\arcmaps\suit_cons_11x17horiz.mxd



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Oroville Facilities Relicensing
FERC Project No. 2100

Figure 5.2-2
(R-15)

Summary of Constraints
Reservoir -- South

Prepared by:	Date	
PJ -- EDAW, Inc.	2/18/04	P:\2000\os016.gis\arcmaps\suit_cons_11x17horiz.mxd